REMARKS

Claims 1, 2, 4 and 6-21 are now present in this application.

Claims 1, 6, 13 and 19 have been amended, and claims 3 and 5 have been cancelled without prejudice or disclaimer. Reconsideration of the application, as amended, is respectfully requested.

Amendments to the Claims

Claims 1, 13, and 19 have been amended to recite that "the organic base polymer and the base material of the proton exchange organic membrane are poly(vinylidenefluoride)-grafted-sulfonated-polystyrene (PVDF-g-SPS), PVDF-g-sulfonated-poly(N-vinylcarbazole), PVDF-g-poly(vinylphosphonic acid), PVDF-g-poly-(4-vinylbenzoic acid), PVDF-g-Sulfonated-poly(2-vinylnaphthalene), or PVDF-g-Sulfonated-poly(9-vinyl-anthracene)," as is recited in original claim 5. Support for this amendment can also be found on page 6, lines 9-14 of the originally filed specification. It is therefore respectfully submitted that no new matter is present in the foregoing amendments.

Rejection under 35 USC 102

Claims 1, 2, 4, 7, 8, 13-16, 18 and 19 stand rejected under 35 USC 102(b) as being anticipated by Rajendran, U.S. Patent 5,981,097, "as evidenced by" WO 96/29752. This rejection is respectfully traversed.

Independent claim 1 recites (emphasis added):

> 1. A layered proton exchange membrane, comprising:

an organic/inorganic composite membrane, comprising inorganic proton conductor and organic base polymer; and

at least one proton exchange organic membrane consisting of an organic component;

wherein the organic base polymer and the base material of the proton exchange organic membrane are poly (vinylidenefluoride)-grafted-sulfonated-polystyrene (PVDF-g-SPS), PVDF-g-sulfonated-poly(N-vinylcarbazole), PVDF-g-poly(vinylphosphonic acid), PVDF-g-poly-(4-vinylbenzoic acid), PVDF-g-Sulfonated-poly (2-vinylnaphthalene), or PVDF-g-Sulfonated-poly(9-vinyl- anthracene).

Independent claim 13 recites (emphasis added):

13. A method for preparing a layered proton exchange membrane, comprising of:

(a) forming an organic/inorganic composite membrane by doping inorganic proton conductor in organic base polymer; and

(b) combining the organic/inorganic complex membrane and a proton exchange organic membrane consisting of an organic component to form a layered proton exchange membrane;

wherein the organic base polymer and the organic component are poly(vinylidenefluoride)-grafted-sulfonated-polystyrene (PVDF-g-SPS), PVDF-g-sulfonated-poly(N-vinyl-carbazole), PVDF-g-poly(vinylphosphonic acid), PVDF-g-poly-(4-vinylbenzoic acid), PVDF-g-Sulfonated- poly(2-vinylnaph-thalene), or PVDF-g-Sulfonated-poly(9-vinyl- anthracene).

Independent claim 19 recites (emphasis added):

19. A direct liquid-feed methanol fuel cell, comprising:

a cathode;

an anode; and

a layered proton exchange membrane, formed by lamination of an organic/inorganic composite membrane with at least one proton exchange organic membrane;

wherein the organic/inorganic composite membrane comprises organic base polymer and inorganic proton conductor; and

the proton exchange organic membrane consists of an organic component;

wherein the organic base polymer and the organic component are poly(vinylidenefluoride)-grafted-sulfonated-polystyrene (PVDF-g-SPS), PVDF-g-sulfonated-poly(N-vinylcarbazole), PVDF-g-poly(vinylphosphonic acid), PVDF-g-poly-(4-vinylbenzoic acid), PVDF-g-Sulfonated-poly(2-vinylnaphthalene), or PVDF-g-Sulfonated-poly(9-vinyl- anthracene).

In independent claims 1, 13 and 19, the organic base polymer and the organic component are PVDF based polymer such as poly(vinylidenefluoride)-grafted-sulfonated-polystyrene (PVDF-g-SPS), PVDF-g-sulfonated-poly(N-vinylcarbazole), PVDF-g-poly(vinylphosphonic acid), PVDF-g-poly-(4-vinylbenzoic acid), PVDF-g-Sulfonated-poly(2-vinylnaphthalene), or PVDF-g-Sulfonated-poly(9-vinyl- anthracene) (see page 6, lines 9-14 of the specification).

With regard to the 35 USC 102(b) rejection, as acknowledged by the Examiner on page 5 of the Office Action, Rajendran does not teach a base polymer comprising PVDF. Accordingly, it is respectfully submitted that the membrane, method and fuel cell of independent claims 1, 13 and 19, respectively, as well as their dependent claims, is neither taught nor suggested by the prior art utilized by the Examiner. Accordingly, reconsideration and withdrawal of the 35 USC 102(b) rejection are respectfully requested.

Rejection under 35 USC 103

Claims 11, 12, 17, 20, and 21 stand rejected under 35 USC 103 as being unpatentable over Rajendran. This rejection is respectfully traversed.

Claims 5 and 6 stand rejected under 35 USC 103 as being unpatentable over Rajendran in view of Asukabe, U.S. Publication 2001/0026893. This rejection is respectfully traversed.

Claims 9 and 10 stand rejected under 35 USC 103 as being unpatentable over Rajendran in view of Murphy, U.S. Patent 6,059,943. This rejection is respectfully traversed.

With regard to the 35 USC 103 rejection, in view of the foregoing amendments, in which limitations from original claim 5 have been incorporated into independent claims 1, 13 and 19, it is respectfully submitted that the 35 USC 103 rejections of claims 11, 12, 17, 20, and 21 in view of Rajendran, and claims 9 and 10 in view of Rajendran and Murphy, should now be overcome.

With regard to the rejection of claims 5 and 6 in view of Rajendran and Asukabe, the Examiner asserts that the artisan would be motivated to use the PVDF base material of Asukabe in the membrane of Rajendran. It is noted, however, that Rajendran discloses many polymers such as TFE, PTFE, and the like, but does not teach or suggest a PVDF based polymer membrane. The invention is classified in a crowded art, therefore, a small step forward should be regarded as significant.

Furthermore, Asukabe only teaches a single polymer electrolyte membrane comprising PVDF-g-SPS (see paragraphs 33 and 34). Similarly to Rajendran, Asukabe also fails to teach or suggest doping inorganic proton conductor in PVDF base polymer to form a PVDF base polymer/inorganic composite membrane. Accordingly, there would be no motivation or reasonable expectation of success to form the PVDF base polymer/inorganic composite membrane from Asukabe, Rajendran, or the combination thereof.

It is also noted that Asukabe fails to teach or suggest combining the PVDF base polymer/inorganic composite membrane and at least one proton exchange organic membrane consisting of the PVDF base polymer to form a layered structure. Instead, Asukabe only discloses that single-layered PVDF base polymer has good electrode adherence, easy

humidification, and excellent stability, and that these advantages cannot be promised in multi-layered structure. It is respectfully submitted that the Examiner has combined these two references based on a hindsight reconstruction of the claims of the present application, as there is no motivation or suggestion in the references themselves.

In view of the foregoing amendments and remarks, it is respectfully submitted that the membrane, method and fuel cell of independent claims 1, 13 and 19, respectively, as well as their dependent claims, is neither taught nor suggested by the prior art utilized by the Examiner. Accordingly, reconsideration and withdrawal of the 35 USC 103 rejections are respectfully requested.

Conclusion

Favorable reconsideration and an early Notice of Allowance are earnestly solicited.

In the event that any outstanding matters remain in this application, the Examiner is invited to contact the undersigned at (703) 205-8000 in the Washington, D.C. area.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

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Respectfully submitted,

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